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| EXAMINER | |
|---|---|
| DOTY, HEATHER ANNE | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2813 | |

DATE MAILED: 09/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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|---|---|---|
| **Office Action Summary** | **Application No.**<br>10/680,295 | **Applicant(s)**<br>TSAI ET AL. |
|  | **Examiner**<br>Heather A. Doty | **Art Unit**<br>2813 |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *21 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1 and 3-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *8* is/are allowed.

6)☒ Claim(s) *1,3-11 and 13-21* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/21/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless – (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States, or (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3-7, 9, 11, 15, and 17-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakajima (U.S. 2002/0020840).

With respect to claim 1, Nakajima teaches a method of passivating a semiconductor device comprising the steps of placing a semiconductor device in a chamber, the semiconductor device having a first type of transistors and a second type of transistors (paragraph 92); introducing a first passivation gas (plasma hydrogenation process using $N_2O$, $N_2$, or $NH_3$, paragraph 91) and a second passivation gas ($SiH_4$, $N_2O$ or $N_2$, and $NH_3$, paragraph 91) into the chamber, wherein the first passivating gas and the second passivating gas are adapted to passivate the first type of transistors and the second type of transistors, respectively (both gases are adapted to passivate both types of transistor); and heating the semiconductor device to a temperature for a period sufficient to passivate the semiconductor device (paragraph 91).

With respect to claim 3, Nakajima teaches a method according to claim 1, wherein the first passivating gas is $H_2$ or $N_2$ ($N_2$, paragraph 91).

With respect to claim 4, Nakajima teaches the method according to claim 3, wherein the second passivating gas is $H_2O$ or $NH_3$ ($NH_3$, paragraph 91).

With respect to claim 5, Nakajima teaches the method according to claim 1, wherein the first type of transistors are PMOS transistors and the second type of transistors are NMOS transistors (thin-film PMOS and thin-film NMOS transistors comprise a CMOS device, paragraphs 52 and 92).

With respect to claims 6 and 15, Nakajima teaches the method according to claim 1, wherein the first and second passivating gases are different gases that are introduced into the chamber simultaneously ($SiH_4$, $N_2O$ or $N_2$, and $NH_3$, paragraph 91).

With respect to claim 7, Nakajima teaches the method according to claim 1, wherein the first passivating gas ($N_2O$, $N_2$, or $NH_3$, paragraph 91) is introduced into the chamber and the semiconductor device is heated to a temperature for a period sufficient to passivate the first type of transistors (200 to 500 °C, paragraph 91), and then the second passivating gas ($SiH_4$, $N_2O$ or $N_2$, and $NH_3$, paragraph 91) is introduced into the chamber and the semiconductor device is heated to a temperature for a period sufficient to passivate the second type of transistors through a plasma CVD process (paragraph 91).

With respect to claim 9, Nakajima teaches the method according to claim 1, wherein the semiconductor device comprises a CMOS circuit of an active matrix display device (paragraphs 2 and 52).

With respect to claim 11, Nakajima teaches the method according to claim 1, wherein the first type of transistors are PMOS transistors (paragraphs 52 and 92) and the first passivating gas is $H_2$ or $N_2$ ($N_2$, paragraph 91), and the second type of transistors are NMOS transistors (paragraphs 52 and 92) and the second passivating gas is $H_2O$ or $NH_3$ ($NH_3$, paragraph 91).

With respect to claim 17, Nakajima teaches a method of passivating a semiconductor device, said method comprising providing the semiconductor device having first transistors of a first type and second transistors of a second type different from the first type (paragraph 92); placing the semiconductor device in a chamber; and passivating the first and second transistors with first (plasma hydrogenation process using $N_2O$, $N_2$, or $NH_3$, paragraph 91) and second passivating gases ($SiH_4$, $N_2O$ or $N_2$, and $NH_3$, paragraph 91), respectively; wherein said passivating comprises introducing the first and second passivating gases into the chamber; and heating the semiconductor device to a predetermined temperature for a predetermined period sufficient for the first and second passivating gases to passivate the first and second transistors, respectively (paragraph 91).

With respect to claims 18 and 19, Najakima teaches that the first and second passivating gases are different gases that are introduced into the chamber simultaneously ($SiH_4$, $N_2O$ or $N_2$, and $NH_3$, paragraph 91).

With respect to claim 20, Nakajima teaches that the first transistors are PMOS transistors, the second transistors are NMOS transistors (paragraphs 52 and 92), the first passivating gas is $N_2$, and the second passivating gas is $NH_3$ (paragraph 91).

Claims 13, 14, 16, and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Tanabe et al. (U.S. 6,723,665).

Regarding claims 13, 14, and 16, Tanabe et al. teaches a method of passivating a semiconductor device, said method comprising placing a semiconductor device in a chamber (**101** in Fig. 9(a)), the semiconductor device having a first type of transistors (PMOS) and a second type of transistors (NMOS—column 14, lines 39-45, column 18, line 62); introducing a first passivating gas ($H_2$) and a second passivating gas into the chamber ($H_20$—column 16, lines 26-42), wherein the first passivating gas and the second passivating gas are adapted to passivate the first type of transistors and the second type of transistors, respectively; and heating the semiconductor device to a temperature for a period sufficient to passivate the semiconductor device (column 16, lines 26-42; heating the sample in the presence of $H_2/H_20$ inherently passivates the two types of transistors, as disclosed in the instant specification on page 3, lines 29-32).

Regarding claim 21, Tanabe et al. teaches a method of passivating a semiconductor device, said method comprising providing the semiconductor device having first transistors of a first type (PMOS) and second transistors of a second type (NMOS—column 14, lines 39-45, column 18, line 62) different from the first type; placing the semiconductor device in a chamber (**101** in Fig. 9(a)), and passivating the first and second transistors with first ($H_2$) and second passivating gases ($H_2O$—column

16, lines 26-42), respectively; wherein said passivating comprises introducing the first and second passivating gases into the chamber; and heating the semiconductor device to a predetermined temperature for a predetermined period sufficient for the first and second passivating gases to passivate the first and second transistors, respectively (column 16, lines 26-42; heating the sample in the presence of $H_2/H_20$ inherently passivates the two types of transistors, as disclosed in the instant specification on page 3, lines 29-32).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakajima (U.S. 2002/0020840) in view of Lane (U.S. 6,670,289).

Nakajima teaches the method as claimed in claim 1 (note 35 U.S.C. 102(b) rejection above), but does not teach that the chamber maintains a pressure between 5 atmospheres and 20 atmospheres.

Lane teaches a method of annealing transistor devices in hydrogen and nitrogen (column 3, lines 10-11) to repair fabrication-induced damage (column 3, line 4) and hydrogenate dangling bonds (column 2, lines 1-4), at pressures between 10 and 25 atmospheres (column 3, line 24).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the method of passivating a semiconductor device as taught by claim 1 and Nakajima by performing the passivation at a pressure between 5 and 20 atmospheres, as taught by Lane, to obtain the invention as specified in claim 10. The motivation for doing so at the time of the invention would have been to perform the passivation at lower temperatures for shorter periods of time, as expressly taught by Lane (column 3, lines 58-62).

### *Double Patenting*

Claim 12 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 8. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

### *Allowable Subject Matter*

Claim 8 is allowable for the reasons presented in the Office Action dated 3/22/2005.

### *Response to Arguments*

Applicant's arguments filed 6/21/05 have been fully considered but they are not persuasive.

In the response filed 6/21/05 (see pages 8-10), Applicant amended claim 1 to include the limitation “wherein the first passivating gas and the second passivating gas are adapted to passivate the first type of transistors and the second type of transistors, respectively." However, since Nakajima teaches that both gases work together in different steps to passivate both types of transistor, the first passivating gas and the second passivating gas are necessarily adapted to passivate the first type of transistors and the second type of transistors, respectively.

Furthermore, in response to Applicant's arguments on page 10, paragraphs 3, 4, and 6, the phrase "passivating gas" is taken to mean any gas that assists in the passivation process, which includes gases used to form passivating layers and gases that act as hydrogen carriers. On page 3, lines 29-32 of the instant specification, Applicant discloses that "it is believed that the passivating gases $H_2O/N_2$ or $H_2O/\ H_2$ not only provide hydrogen atoms which bond with the broken bonds of silicon, but also diffuse into the poly-crystalline Si thin film to passivate the poly-Si grain boundaries thereby overall providing a more robust device." In the instant specification, the gases $H_2O/N_2$ or $H_2O/\ H_2$ act as carriers for the hydrogen that bonds with the silicon to passivate the devices. Therefore, in Nakajima, the gases $SiH_4$, $N_2O$, $NH_3$, $N_2$, and $N_2O$ (see paragraph 0089) are all considered passivating gases, and Nakajima teaches examples of different passivating gases being introduced simultaneously and also the first passivating gas being introduced before the second passivating gas.

## *Conclusion*

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather A. Doty, whose telephone number is 571-272-8429. The examiner can normally be reached on M-F, 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**DAVID BLUM**
**PRIMARY EXAMINER**

had